

REMARKS

Claim 15 was objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Claim 15 has been cancelled. Claim 16 has been amended so that it is dependent upon claim 1. Accordingly, it is respectfully requested that the Examiner withdraw the objection under 37 C.F.R. 1.75(c).

Claims 2-10, 12, 13, 16-19, 22, 23, 30 and 31 are rejected under 35 U.S.C. 112, second paragraph. Claim 3 was rejected because bisphenol A and bisphenol F resins are not thermally curable without some other groups present. As stated in claim 1, the thermal curable resin is coupled with the imidazole-anhydride adduct to provide thermal curing. None of the stated resins in claim 3 will cure without a catalyst; however, all of the resins are curable with a catalyst as set out in claim 1. Thus, it is respectfully requested that the Examiner will withdraw the rejection to claim 3. The typographical error of "pyromellitic" has been corrected in claims 7 and 31. "Propylene glycol methyl ethyl acetate" as used claims 12 and 13, also contains a typographical error and has been amended to "propylene glycol methyl ether acetate" in claims 12 and 13 and the specification. Claim 16 has been amended to delete the phrase "such as". Claims 2, 6, 12, 13, 16, 22, 23, 24 and 30 have been amended as suggested by the Examiner to place them in proper Markush form. Claim 23 has been amended to address the Examiner's rejection. Markush group of claims 6 and 30 are directed to anhydride-imidazole adduct and not for anhydrides. This invention does not require any hardener such as an anhydride, instead, only a latent catalyst is necessary for this invention. The latent catalyst is composed of an imidazole-anhydride adduct. Both claims 6 and 30 describe possible imidazoles and anhydrides to prepare the adduct. Accordingly, it is respectfully requested that the Examiner withdraw the rejections to claims 2-10, 12, 13, 16-19, 22, 23, 30 and 31under 35 U.S.C. 112, second paragraph.

Claims 1-6, 9-12 and 14-30 have been rejected under 35 U.S.C. 103(a) as being unpatentable over U. S. Patent 6,746,896 issued to Shi et al in view of DD 218377 or JP07224153. Claim 15 has been cancelled. Shi discloses that the wafer-level compressive-flow underfilling layer is composed of epoxy resin, organic curing hardener, latent curing catalyst, fluxing agent, and filler (col 12, lines 38-45). Patent DD 218377 discloses that a mixture of 0.20g

tetrahydrophthalic anhydride, 1.93g epoxy novolak, and 1.00g novolak produces a less bubbled material (abstract). The JP 07224153 patent utilizes imidazole, acid anhydride in an organic medium containing carbonyl group (abstract). In contrast to Shi, the present invention requires a resin, imidazole-anhydride adduct as the latent catalyst, solvent, and fluxing agent and does not require an organic curing hardener. Thus, the present invention does not utilize one of Shi's key components, anhydride as organic curing hardener. Likewise, the '377 material also utilizes an organic curing hardener. There is no motivation or suggestion for combining the teachings of the reference because the present invention does not utilize the organic curing hardener. Unlike JP '153, the present invention has strong acids and bases as fluxing agents composed in the underfill matrix. However, a person who possesses ordinary skill in this art would realize that the addition of a strong acid or base in a multi-component system of the adduct, solvent, and resin would result in interference. As the amount of fluxing agent doubled in Example 1 and 3 of Table 1, the viscosity drops by about a 1,000cP in Table 2. In addition, as more fluxing agent is added, the T_g of the material decreases. Hence, there is no suggestion that the adduct can be used to B-stage and cure for this invention. Strong acids and bases in a liquid medium with the adduct may destabilize it and may cause premature curing. Hence, there is no teaching that the addition of the adduct would result in a material that can B-stage, dice, solder-interconnect, and cure above the solder reflow temperature.

Furthermore, even if Shi's patent is combined with DD 218377 or JP 07224153, the net result would be a different invention than the present Application. Because both Shi and '377 utilize a curing hardener such as novolak resin, the material will have different B-stage capabilities. Also, the combination would also result in a two-layer system of underfill for solder interconnection and the final cure. Shi discloses two separate layers of wafer level underfill. Shi applies the first layer of material onto the wafer, solidifies the layer, dices the solid material into individual chips, then covers the top of the bumps with a second layer, a tacky film. The first layer is a solvent or solvent-free material that is composed of epoxy resin, hardener, latent curing catalyst, fluxing agent, and a filler. The second layer, tacky film, consists of epoxy resin, organic curing hardener, latent curing catalyst, fluxing agent. Unlike Shi, this invention does not require

two layers of materials. Rather, a non-tacky single material can achieve B-stage, dice, flux, and cure. Hence, the present invention is superior because it discloses a one layer material that can be B-staged, diced, solder-interconnected, and cured above the solder reflow temperature. Accordingly, in view of the distinctions set forth above, it is respectfully requested that claims 1-6, 9-12, 14 and 16 -30 are patentable under 35 U.S.C. 103(a) over Shi et al in view of DD 218377 or JP07224153.

Claims 1-6 and 9-30 have been rejected under 35 U.S.C. 103(a) as being unpatentable over Shi et al in view of DD 218377 or JP 07224153 in further view of U. S. Patent 6,265,776 issued to Gilleo. The distinctions between the present invention and Shi, DD 218377 and JP 07224153 set forth above are equally applicable to the present rejection. Gilleo teaches away from combining underfill material with flux materials. Gilleo teaches that properties required for a good flux and those required for a good underfill are not compatible (col 2, lines 43-44). Further, Gilleo utilizes solvents in the flux material and not in the underfill materials. Consequently, even if all of the references are combined, it would not lead one skilled in the art to the present application. The combination would be a two layered material, one of underfill and another of flux. The present invention is material that combines both flux and the underfill into a single layer that can B-stage, dice, flux and cure without the requirement of another layer. Hence, this invention has superior capabilities than the prior arts. Accordingly, it is respectfully submitted that claims 1-6, 9-14 and 16 - 30 are patentable under 35 U.S.C. 103(a) over Shi et al in view of DD 218377 or JP 07224153 in further view of Gilleo.

Claims 1-6 and 9-30 have been rejected under 35 U.S.C. 103(a) as being unpatentable over Shi et al in view of DD 218377 or JP 07224153 in further view of U. S. Patent 6,458,472 issued to Konarski et al. The distinctions between the present invention and Shi, DD 218377 and JP 07224153 set forth above are equally applicable to the present rejection. Konarski teaches away from using a non-reactive diluent (column 8, lines 15-17). Konarski utilizes reactive co-monomer component which include monofunctional or certain multifunctional epoxy resins (column 8, lines 20-21). Examples include monofunctional epoxy resins of C₆₋₂₈ alkyl lucidly ethers, C₆₋₂₈ fatty acid lucidly esters and C₆₋₂₈ alkyl phenol lucidly ethers. Unlike Konarski, this

invention utilizes a non-reactive solvents that readily dissolves the epoxy resins and have the boiling point ranging from 100°C to 200°C. The solvent will evaporate during the B-stage process and not react with any other components in the underfill. Furthermore, even if all of the cited references are combined, it would not result in this invention. The combination would result in premature curing due to the reactive co-monomer of Konarski. If premature curing occurs, then this would jeopardize the solder interconnection and will not result in this invention. Accordingly, it is respectfully submitted that claims 1-6 , 9-14 and 16 - 30 are patentable under 35 U.S.C. 103(a) over Shi et al in view of DD 218377 or JP 07224153 in further view of Konarski et al.

Claims 1-31 have been provisionally rejected under obviousness-type double patenting over the co-pending Application No. 10/084873. A terminal disclaimer in compliance with 37 CFR 1.321C is being filed along with this reply. Accordingly, it is respectfully requested that the Examiner withdraw the rejections under obviousness-type double patenting over co-pending Application No. 10/084873.

In view of the foregoing, it is respectfully submitted that the present application is in condition for allowance. If there are any issues that the Examiner wishes to discuss, he is respectfully invited to contact the undersigned attorney at the telephone number set forth below.

Respectfully submitted,



Charles W. Almer
Reg. No.36,731
Tel. No. 908 707-3738

National Starch and Chemical Company
10 Finderne Avenue
Bridgewater, NJ 08807